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COVER

Johnnie S. Martinez, ISD-1 photographer, spent a less-than-comfortable, but interesting, afternoon recently photographing physicist Tom King, demonstrating the climbing technique of stemming for the cover photo, and MP-9 engineer Don Liska, shown demonstrating climbing techniques on Pages 18-20.

BACK COVER

Martinez traveled to the Valle Grande area for the tranquil back cover photo.

Chester Smith, MP-8 drafting supervisor and lead design draftsman on the Bicentennial magnet project, shows Diane Johnson, MP-8 draftsman, the beam exit on a model of the red, white, and blue magnet and spectrometer stand.

Adding Color to Experiment

Bicentennial Magnet is Built

About 3 years ago a group of scientists devised an experiment in pion-nucleus scattering and received approval to conduct the experiment on a secondary beam line at the Clinton P. Anderson Los Alamos Meson Physics Facility (LAMPF) at the Los Alamos Scientific Laboratory.

The scientists, Robert Burman of LASL, Barry Preedom of the University of South Carolina, and Kazuo Gotow, David Jenkins, and Marvin Blecher, all of Virginia Polytechnic Institute and State University, located an old magnet at Florida State University suitable for their experiment but in need of extensive refurbishing and a new structural support stand that would permit its use in a magnet spectrometer system.

Armed with the old Florida State magnet body (14,000 pounds of iron) and their requirements list for new magnet coils, a spectrometer stand, and vacuum chambers, they came to LAMPF's engineering support group, MP-8, for help.

The magnet and stand system were designed and constructed to meet the requirements of the experimenters at a cost of about $30,000.

Since the experiment was scheduled to be run in 1976, the name Bicentennial seemed appropriate for the apparatus, and the color

scheme could be none other than red, white, and blue.

Engineering was done by Ed Bush and Steve Koczan, and technicians Richard Martinez and Gilbert Gonzales assembled the magnet and stand.

Final preparations are being made for moving the apparatus to the experimental area, and sometime in October the experiment is scheduled to begin.

People in several MP groups—most of them seldom, if ever, recognized publicly for their efforts—collaborated with MP-8 to bring Bicentennial to its present stage of development, and even more people will be involved in last minute activities to make the apparatus ready for the experiment.

Their work is an example of what goes on quietly, daily, to provide magnets, an essential ingredient in all LAMPF experiments.

Indispensable Ingredient— The Magnet

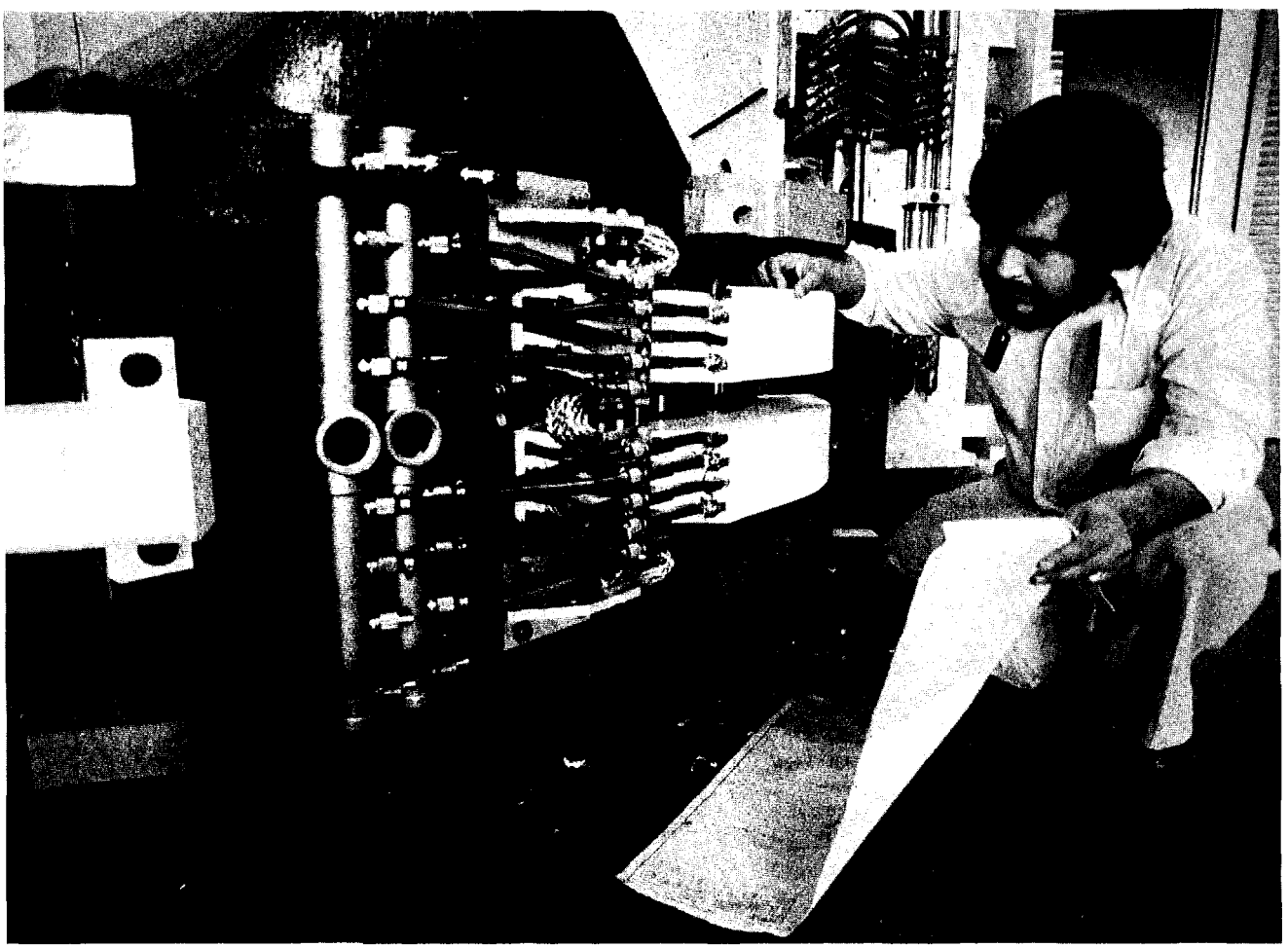
During any given period of beam time (when the accelerator is emitting the main beam of high-velocity protons) many experiments may be under way simultaneously, including a half dozen or more in the main experimental area (Area A).

These Area A experiments are staged on secondary beam lines, which contain newly born, often short-lived particles (such as low-energy pions to be used by Burman and his associates in their experiment) released when main beam line protons interact with atoms in the targets in Area A.

Scientists use magnets to focus, de-focus, bend, disperse, or otherwise direct the particles to detectors on the secondary beam lines in accordance with the nature of their experiments.

LAMPF attracts scientists involved in medium energy physics from all over the world. Most of them bring detectors and computer and electronic equipment, but cannot bring magnets which, depending on the experiment, may weigh many tons.

LAMPF maintains a pool of



Lead mechanical technician on magnet re-build, Richard Martinez, consults plans to inspect part of the Bicentennial magnet.

about 80 magnets, which are available to visiting and LASL scientists and can be modified to meet specifications of experiments on the secondary beam line. New magnets usually cost about $3-$5 a pound, and modifying pool magnets presents a lower cost.

A pool magnet usually requires some repair or replacement of parts, and extensive redesigning may be necessary.

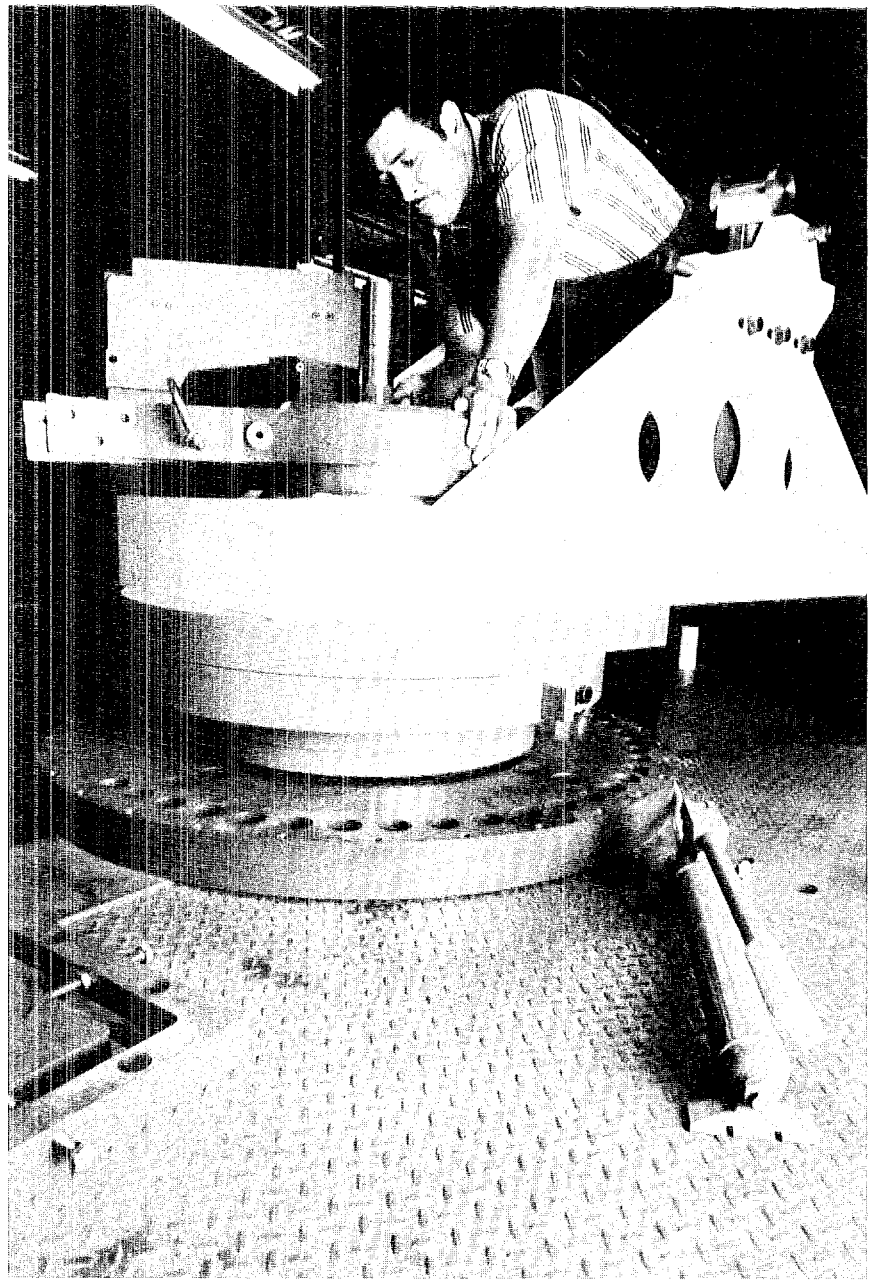
Many magnets are stored (sometimes outside LAMPF buildings) near the experimental areas, covered with tarps and protected with antifreeze, which replaces the cooling water and prevents possible damage to magnet parts from freezing.

After a scientist gets LAMPF Program Advisory Committee approval for a particular experiment, he or she begins working with MP-8 to select a magnet. Or, as was the case with Bicentennial, a scientist may locate a magnet listed as excess property at another scientific laboratory or a university and have the magnet shipped to Los Alamos for modification.

Working closely with MP-8 in various stages of magnet preparation are MP-11, which ensures that the correct amount of power is supplied, and MP-13, which conducts extensive mapping of the magnetic field. MP-7 provides cooling water when the electromagnet is in use.

Water and electrical currents running simultaneously through a magnet present a potentially dangerous situation. Therefore, numerous safeguards are built into the electromagnets to prevent injury to persons, loss of power, or damage to hardware during experiments.

Flow switches automatically shut off the electrical power if the water flow is impeded, and thermal switches shut off the power if the magnets begin to overheat. There also are ground protection devices which shut off power if the coil or grounds develop problems. An instrument panel indicates "load ready" and "power supply ready" if all systems are operating cor-



Gilbert Gonzales was lead mechanical technician in construction of the spectrometer stand to support the magnet according to experimenters' specifications.

rectly, and the electromagnet can be turned on.

The MP groups work together in all aspects of magnet preparation, and a critical and physically demanding service is performed by the crane and forklift operators and the technicians on the floor who position the magnets exactly on the beam lines.

Zia forces, which are under contract to provide maintenance to LASL, operate the high-capacity mobile cranes when the magnet involved weighs more than the capacity of the LAMPF overhead cranes in the main experimental area. Zia plumbers also play an important role in connecting water supplies to the magnets.

The 2 most commonly used electromagnets at LAMPF are quadrupole and bending magnets.

Quadrupole magnets are similar to lenses, in that they focus or defocus a beam of particles. If the particles, when passing through the hole in the center of a quadrupole magnet, stray, they are focused or "corrected" into a tighter beam. Or, if it is the purpose of the magnetic field in the magnet, the beam particles can be de-focused and become less confined.

A bending magnet acts essentially like a prism. Particles are dispersed and bent in a manner prescribed by the experimenter. The magnetic field is created in which charged particles of specific energies can be forced to bend in desired ways, revealing characteristics of the particles.

Magnets seem to acquire personalities and many eventually acquire names. In the LAMPF pool are magnets obtained from the Cambridge Electron Accelerator (CEA) which used names such as Scylla, Eurydice, and Karen, from Greek mythology, classical literature, and the roster of CEA secretaries. Other magnets have been named at LAMPF; examples are Zozobra, Robucker, and Bicentennial.

Many of the scientists, engineers, and technicians who deal daily with magnets seem to agree that the huge pieces of iron deserve names, maybe some color, and recognition.

Recognition also is appropriate for the MP workers who support the LAMPF users by providing an indispensable ingredient for experiments—the magnet.

Ron Harrison, experiment engineer, center background, inspects work being done on a 35-ton hodoscope bending magnet from the Laboratory's magnet pool, as Tink Weiler, front, and Mike Perez and Carl Welch adjust chamber supports. The magnet has been modified to meet the needs of a particular experiment scheduled this fall at LAMPF. Among changes made by technicians are addition of instrument supports and a target.

Devi Raju of Self Help, Inc. discusses progress with a client.

Residents of Casa Mesita, from left, Lulu Muniz, Lucy Valencia, Maria Baca, and, far right, Danita Dunsworth, help Linda Marie Schlosser and her husband, Paul, houseparents, unload groceries.

United Way: People Helping People

The Los Alamos Area United Way is many things. It is 20 human care agencies. It is 1 fund drive, not 20, and it is services for everyone for a better community. It is people, volunteers, helping other people.

It is help, and helping.

This year the Los Alamos Area United Way is trying to reach a fund-raising goal of $217,000, and two additional organizations have joined the United Way--Self Help, Inc. and Casa Mesita.

Casa Mesita in Los Alamos is a specialized group home for teenage girls. Established in 1972 by a group of concerned Los Alamos residents, the home at present provides a warm, secure, and emotionally healthy atmosphere for 4 girls.

Paul and Linda Schlosser, houseparents, ensure that the girls have 24-hour-a-day, 7-day-a-week professional care. The home needs the community's financial support, as only a small portion of the money to pay the expense of taking care of the residents comes from government agencies.

Self Help, Inc. is a nonprofit organization created to encourage self-reliance and economic independence among the people and communities of Northern New Mexico, and it attempts to strengthen cultural and social understanding in this multicultural area.

The principal strength of Self Help continues to be the provision of free legal assistance to individuals, communities and nonprofit organizations in those communities. Devi Raju, an attorney from India, is executive legal director.

Helping is the United Way, and through financial support--your gift--you can help many people to know hope, care, and love.

The Los Alamos Area United Way trustees this year are Lore Watt, president, Michael D. Coburn, vice president, Vivian M. Malik, secretary, Robert J. Kriz, treasurer, William E. Keller, financial secretary, Louis H. Bunch, Charles B. Cozzens, Jean M. Elder, A. Carolyn Linnebur, Lawry Mann and William J. McCreary.

UNITED WAY PARTICIPATING AGENCIES AND CAMPAIGN GOALS

Casa Mesita, $5,000; Self Help, Inc., $1,000; Arthritis Foundation, New Mexico Chapter, $2,500; Jemez House, $29,000; Salvation Army, $6,500; Cystic Fibrosis Foundation, New Mexico Chapter, $4,400; Los Alamos Visiting Nurse Service, $12,000; American National Red Cross, Los Alamos Chapter, $8,700; Los Alamos Family Council, $30,000; Los Alamos Heart Association, $7,400; Boy Scouts, Greater Southwest Area Council, $12,000; Girl Scouts, Sangre de Cristo Council, $13,500; Los Alamos Cancer Clinic, $15,000; Chaparral Home and Adoption Services, $1,750; New Mexico Council on Crime and Delinquency, $1,000; U.S.O., $675; Los Alamos Family YMCA, $10,000; Los Alamos Sheltered Workshop, $20,000; Los Alamos Council on Alcoholism, $8,000; Los Alamos Association for Retarded Citizens, $9,000.

Mining Oil Shale:

Research May Indicate *In Situ* Processing Environmentally Acceptable, Less Expensive

The term "oil shale" is a misnomer. Oil shale doesn't contain oil, and it isn't shale.

But the Energy Research and Development Administration (ERDA) isn't letting a misnomer stand in the way of a rapidly expanding interest in oil shale as a source of energy.

At stake is almost 2 trillion barrels of oil—a 200-year supply at present U.S. consumption rates—in a 17,000-square-mile area of the Rocky Mountains.

Oil shale actually contains kerogen, an organic substance from which oil can be produced, and it is a marlstone, not a shale, according to geologists.

Energy companies have known about the huge oil-shale deposits for many years, but it hasn't been economically feasible to extract the shale and process it to make petroleum products.

Los Alamos Scientific Laboratory has funding from ERDA's Division of Fossil Energy to investigate ways to fracture deposits of shale 1,000 to 2,000 feet underground in the Green River Basin of Colorado, Utah, and Wyoming in preparation for oil extraction by the *in situ* (in place) method.

In situ processing is an environmentally attractive concept. It eliminates strip mining or extensive conventional mining, and would, if the technology could be perfected, make extracting petroleum products from oil shale attractive economically.

The LASL effort is centered in the shock wave physics group (M-6) and includes heavy participation by the detonation physics group (M-3), the underground containment group (J-9), the hydrodynamics group (T-3), and the equation of state and opacity group (T-4).

LASL research at present is threefold: measurement of the shock wave properties of oil shale, research into characteristics of explosives, and design of a computer model to predict the effects of a given charge of a specific explosive in a carefully studied underground rock formation.

Knowledge gained from material and explosives testing in the Laboratory's Ancho Canyon and Kappa sites, and the carefully prepared computer models, will allow LASL to conduct 4 field tests in Colorado in fiscal year 1978. The tests will be small, and will test the prediction capabilities and accuracy of the computer model.

Bill Carter, project manager at LASL of the ERDA oil shale program, says the 4 initial tests will be used to check the computer codes, and no attempt will be made to process the rubblized shale (shale rock fractured to pieces 6 inches in diameter by explosives) into oil.

Properties of this 1-ton slab of oil shale, which contains from 25-30 gallons of oil in rich organic material, are examined by John Hopson, left, and William Carter. Hopson, M-6 group leader, and Carter, alternate group leader, head the LASL part of an Energy Research and Development Administration program that is looking for ways to extract oil from shale in the Green River Basin in Colorado, Wyoming and Utah.

Carter predicts that in fiscal year 1977 the first version of the computer models will be ready. Ultimately, computer models will produce a code sufficiently complex and technical to enable energy companies to tailor the code to each retort (bed of rubblized shale) site.

"The goal of our research in this area is to design a commercial retort to allow maximum processing and extraction efficiency of petroleum products by the modified *in situ* method," said Carter.

He explained that modified in-place processing requires a standard designed mine shaft to be drilled to the oil shale layer, with several horizontal shafts extending from the main shaft.

As the typical mine shaft is cut into the shale deposit, as much as 20 per cent of the shale in the designated retort might have to be mined by conventional methods before the explosive devices can be properly set to get maximum rubblization.

After the vertical and horizontal shafts are mined, a concrete sump is built across the bottom of the proposed retort, and a vertical shaft, containing pipes leading to the sump, is drilled alongside the retort area. The pipes will pump out whatever petroleum products settle to the sump.

Explaining the process, Carter said the explosive charges are set off, and the shale rock is fractured to fragments no larger than 6 inches in diameter.

The rubblized shale becomes the retort, a volume contained within a cube approximately 500 feet to a side.

The shale is ignited at the bottom of the retort by propane or some other fuel source installed above the sump area and burns constantly and evenly for up to a year, depending on the grade of the shale.

"The burn must be controlled precisely, usually at temperatures from 800-900 degrees Fahrenheit. If too much heat is applied, the rock decomposes, and the kerogen is simply burned. Not applying enough heat, of course, fails to break the bonds holding the kerogen in place," said Carter.

The mist given off by the burning kerogen condenses into an oil product and settles into the sump at the bottom of the retort. The oil then is pumped to the above-ground facility.

So, by the modified *in situ* method, which is a combination of conventional mining techniques and exactly controlled explosive charges set off to fracture the shale, oil can be extracted with fewer adverse environmental effects, and at a lower expense, than by conventional mining methods alone.

Explosives Experience at LASL Appears Vital

Successful fracturing and burning of a retort 500 feet to a side may produce 5 million barrels of oil.

Carter mentioned that the 600-square-mile Piceance Basin of northwest Colorado contains the richest oil shale deposits in the 3-state area being studied.

In situ processing of oil shale might require a tenth as many people as are necessary in conventional mining, and no massive above-ground plants with their associated problems of transportation, water supplies, large labor force, and visual and actual pollution of the environment.

An above-ground processing plant capable of producing 100,000 barrels of oil a day from shale can be built for about $1 billion, according to Carter. Through the modified *in situ* method the capital investment is much less, since the shale is processed underground and comes to the surface as oil to be handled through pump stations. The cost, in the hundreds of millions of dollars, still would be the prime factor in developing in-place processing.

The shock wave physics group's experimental material characterization and the computer modeling program are only part of the total picture. Characterization of explosives, the work of the detonation physics group, is the other essential element in the oil shale program.

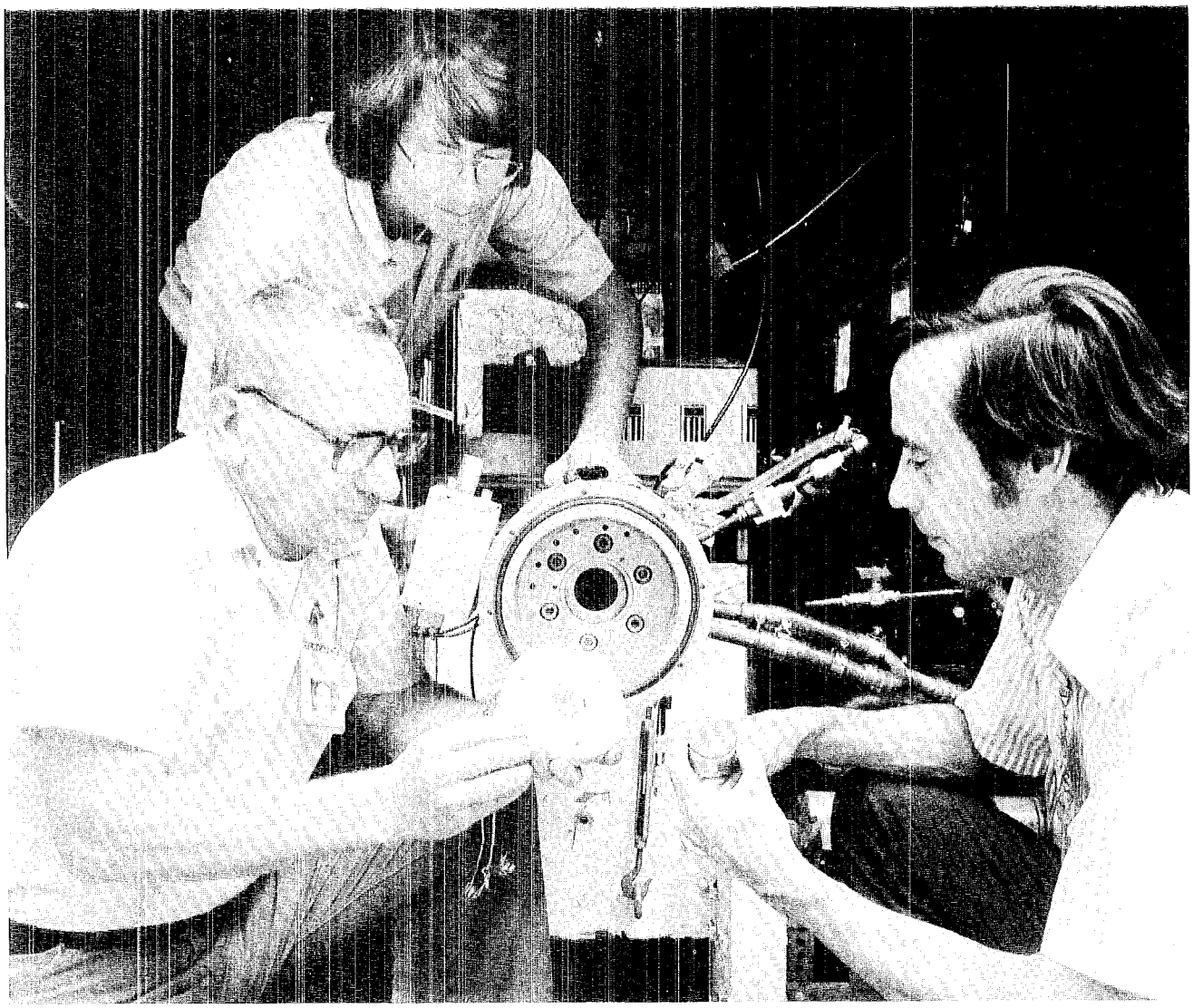
The group has done much research with ammonium nitrate fuel oil (ANFO). It is not an ideal explosive, since its performance is dependent on geometry, but it is cheap. ANFO costs 12 cents per pound, and it takes about 1 pound of the explosive to fracture to desired dimensions 1 ton of shale rocks.

Considering the tonnage of rock in a standard-size retort volume, the cost for ANFO explosives for each retort could amount to $1 million. "If you can save a penny per ton of rock on explosive costs, you save $100,000 per retort shot," added Carter.

ANFO, a solid explosive, detonates and then normally dies. It gives off large quantities of gas, has slow rise times and lasts a long time in comparison to more intense explosives producing less gas pressure. The long-term properties of ANFO make it good for breaking rock.

The detonation physics group also is studying liquid explosives, but liquids are more suited to true *in situ* processing, whereby an explosive charge is placed in shale deposits through a shaft drilled from the surface of the earth. No mining is required.

True *in situ* processing would be the ideal way to extract oil shale, but physics dictates that this

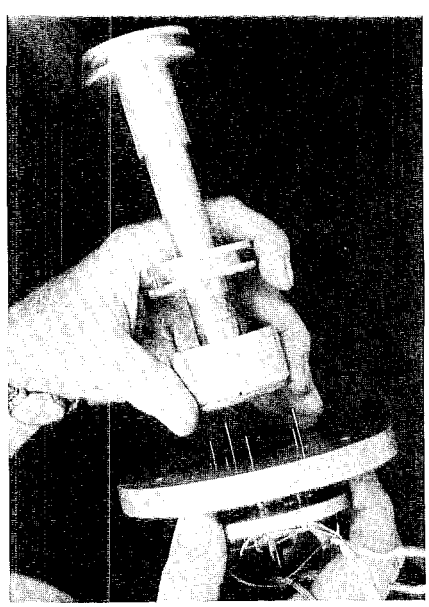


method, with present technology, will not be effective. If a free volume is not created before the explosion, the fractured rock in the retort has no place to expand, unless the earth's surface is pushed upward. From a depth of 2,000 feet, it is improbable that the limited explosive charge used to fracture the shale rock to a desired size could also cause the overlaying rock and soil to expand, creating the necessary volume to make true *in situ* processing effective.

One experimental method of creating some volume in the fracture area is to use CO_2 and steam under pressure to dissolve some rock. Another way is to leach out

continued on next page

Charles Caldwell, left, firing point supervisor with Shock Wave Physics Group (M-6), John Hopson, M-6 group leader, and William Carter, alternate group leader, examine equipment used in testing which could lead to development of methods of fracturing oil shale 1,000 to 2,000 feet below ground. Caldwell holds a mounted chip of oil shale which will be shattered by the projectile, held by Carter, after the projectile is fired from the cannon in the background. The tests will provide information on what happens to oil shale as it fractures. At right is a picture of the projectile and the device on which is mounted the chip of shale.



some of the soluble impurities in the deposit. If a volume can be created, then use of liquid explosives for true *in situ* processing can come closer to reality.

"Explosives have been used in mining and blasting for hundreds of years, but there are very little data on the characteristics of commercial explosives upon which to build our research," commented Carter.

To accumulate knowledge about the character—especially the time rate of energy release and volume of gas over a given period of time—of commercial nonideal explosives is much of the work of the detonation physics group.

The main thrust of the ERDA program is extraction of oil, but high-quality synthetic gas conceivably could be produced from the oil shale deposits in the Green River Basin. The Institute of Gas Technology has data indicating that gas could be produced from rich oil shale at the rate of 100 cubic feet for each gallon of shale oil, or 5,500 cubic feet for each barrel.

By 1985, up to 2 million barrels of oil a day may be taken from the Green River Formation, according to Carter, and the combination of oil and gas production would make economic sense.

Further economic benefits may be derived from the shale beds in the 3-state area, including mining of minerals such as nahcolite, a source of sodium carbonate and sodium bicarbonate, and dawsonite, a source of aluminum.

Participating in the ERDA oil shale program, in addition to LASL, are Sandia Laboratories at Albuquerque, Lawrence Livermore Laboratory in California, the Laramie (Wyoming) Energy Research Center, which has overall charge of the program, several universities, and several federal agencies.

LASL's long involvement with the nation's weapons program has produced an expertise in the controlled use of high explosives that appears vital to the preparation of the shale beds by fracturing for *in situ* processing.

"At present we have funding only for fracturing research," said Carter, "but there are several other energy-related programs in which we are gradually becoming involved."

These include underground coal gasification, more sophisticated explosives to aid geothermal research, studies of containment problems, increasing productivity from stripper wells in oil fields in many parts of the country, and fracturing and chemical treatment of Devonian shales in the eastern United States to stimulate natural gas production there.

PIGMI Program Underway at LAMPF

Los Alamos Scientific Laboratory is beginning a 3-year program in which the Laboratory's linear accelerator (linac) technology and experience will be used to develop a pion generator for use in hospitals and medical centers.

The Pion Generator for Medical Irradiations (PIGMI) program, supported by the National Cancer Institute of the Division of Cancer Research Resources and Centers, Department of Health, Education and Welfare, currently is funded with $2 million for the 3-year period which began in July.

Edward Knapp, associate division leader for accelerator operations in MP Division, is the principal investigator for the PIGMI program, and Donald Swenson, MP-3, is project coordinator.

The length of the PIGMI is expected to be about 150 meters (about 500 feet), a size small enough to permit a hospital to consider installation of the accelerator for use in its cancer treatment program.

Swenson said the much shorter length of the PIGMI will allow a hospital to construct the accelerator underground, under a parking lot, for instance.

Modifications to existing linac design, and several innovations, will make it possible for a hospital to operate PIGMI with a smaller staff than is required at a large accelerator facility.

The cost of a pion generator such as PIGMI is a factor to be considered by a hospital or medical center, and Swenson says that no accurate cost figures are available yet, although the "very rough" estimate of $10 million has been mentioned.

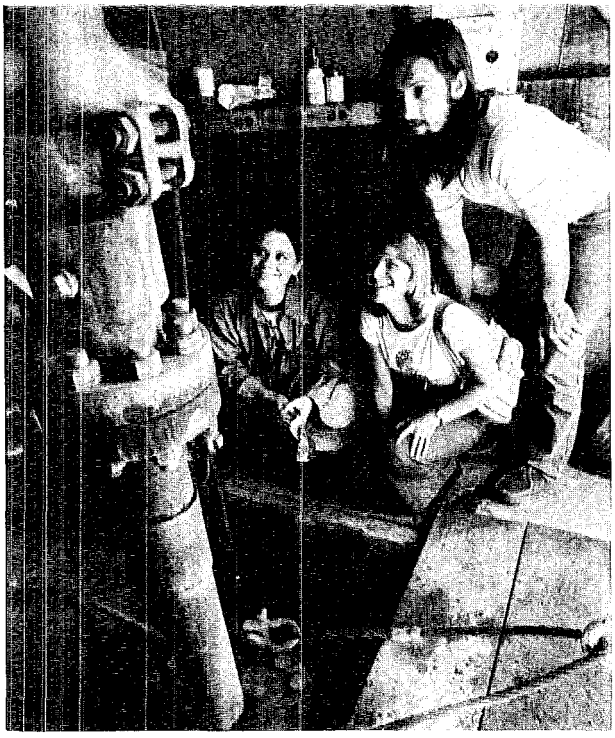
Although PIGMI will be considerably smaller than the linac at the Clinton P. Anderson Los Alamos Meson Physics Facility, the proton energy produced will be about 650 MeV, compared to the 800 MeV generated by the one-half-mile-long LAMPF.

Changes in linac design that will make PIGMI acceptable in size and service requirements for medical application include the increase in resonant frequency of the structure which will reduce the diameter of the cavity, the increase in acceleration gradient which will reduce the length of the facility, the use of permanent quadrupole magnets in the drift tube linac (which will eliminate a lot of technical servicing), a design in the beam focusing linac that makes possible a much smaller linac section capable of emitting a more compact beam, and a 250 Kv injector much smaller than the Cockcroft-Walton injectors at LAMPF.

By the end of the grant period, a low-energy prototype (10 MeV) pion generator is expected to be completed with extensive beam tests having been conducted.

Science Fair Winners Tour LASL

Warren Quinn, CTR-3 group leader, explains controlled thermonuclear research at LASL to, far right, science fair winner Frank Johnson and his escort, Mrs. Patsy Boudreaux, both of Ruston, Louisiana, and Greg Weeks, center, and his Farmington, Missouri High School teacher Murray Norman.



Science fair winner Joan Gjostein, center, and her escorts, Zachary and Janet Drewniak, all of Dearborn, Michigan, inspect drilling equipment at LASL's geothermal site in the Jemez Mountains.

Assistant Group Leader of ISD-2, Bob Brashear, with back to camera, takes the science students, 3 winners of the 27th International Science and Engineering Fair for high school students, and their sponsors on a tour of the Bradbury Science Hall and Museum. The students' 4-day visit to LASL was sponsored by ERDA as a special award for their outstanding energy-related exhibits at the science fair.

Darleane Hoffman on Committee

Solution to Disputes Sought

Part of a dispute, now more than 10 years old, concerning priority of discovery and recommended names for elements 104 and 105, may be headed for a solution this year.

Scientists at the Dubna Joint Institute for Nuclear Research in the Soviet Union have scheduled for this fall an experiment they predict will substantiate their claim to discovery of element 104, for which they have proposed the name Kurchatovium.

The Lawrence Berkeley Laboratory (LBL) in California also claims to have discovered element 104, and scientists there have proposed the name Rutherfordium.

A scientist from LBL is expected to be on hand for the experiment in Dubna to observe and possibly to bring the written test results to the U.S.

Because of the dispute over elements 104 and 105, the International Union of Pure and Applied Chemistry (IUPAC) and the International Union of Pure and Applied Physics (IUPAP), groups that serve as mediators in helping determine who has the right to claim what, jointly appointed a neutral committee in 1974 to consider the U.S. and Russian claims.

Darleane Hoffman, associate group leader of CNC-11 (part of the Chemistry-Nuclear Chemistry Division at Los Alamos Scientific Laboratory) is one of 3 Americans on the committee, which also includes 3 Russians and 3 persons from countries not directly involved in the dispute.

Hoffman says that after the fall experiment in Dubna, the American members of the committee will write a report to the chairman covering the latest experiment, the history of the disputed claims, suggested criteria for identifying and naming new chemical elements, and recommendations which, if implemented, might help avoid future disputes of this nature.

The report will be submitted to IUPAC with hope that a compromise solution can be found that will satisfy both American and Russian scientific communities.

The original Dubna claim to discovery of element 104 in 1964 was based on detection of a 300-millisecond spontaneous fission activity in the bombardment of ^{242}Pu with ^{22}Ne, which they assigned to $^{260}104$. This finding could not be verified, and Russian scientists, through similar experimentation in 1968, reported the half life to be about 100 milliseconds, and later said it was 80 milliseconds.

The LBL claims to discovery of element 104 are based on their observation in 1969 of 2 alpha decaying isotopes, 4.5-second $^{257}104$ and 3-second $^{259}104$. The assignments were made from detection of the growth of known nobelium (element 102) daughter activities. In 1973, Oak Ridge National Laboratory scientists, using a different method, verified the Berkeley results.

The 80-millisecond activity was

detected again by the Dubna group in bombardments of ^{249}Bk with 82- to 84-MeV ^{15}N ions last fall. However, similar bombardments were repeated at Berkeley this spring in the presence of a Russian observer and no 80-millisecond spontaneous fission activity could be found, although a 20-millisecond activity was detected.

The same experiment is scheduled to be repeated in Dubna this fall, in the presence of a Berkeley observer.

"I have written a letter to Professor Flerov at the Institute at Dubna sending the results of our independent analysis of the data from the May experiments at Berkeley and offering the services of LASL in conducting a neutral analysis of the spontaneous-fission data from the various bombardments at Dubna," said Hoffman.

Hoffman presided at a recent informal meeting in Corsica at which Berkeley and Dubna groups attempted to reach agreement on conflicting test results. No satisfactory explanation for the difference in results could be found.

The Berkeley group cannot find the 80-millisecond activity in the same kind of experiment in which the Dubna group claims to see it.

Hoffman, in addition to serving on the neutral committee, assisted 8 other scientists from the United States and other countries this year in compiling a paper on criteria for the discovery of chemical elements. The paper is to be published soon in *Science* magazine.

As stated in the paper, "The basic criterion, of course, must be the proof, by some means, that the atomic number (Z) of the new element is different from the atomic number of all previously known elements."

The paper discusses several methods regarded as acceptable in attempting to identify a new element. These include chemical identification, identification of characteristic x rays emitted by the new element itself or in connection with its decay, and proof of its genetic decay relationship to a previously known element through an alpha particle decay chain. It is pointed out that simply detecting a spontaneous fission activity and measuring its half life does not establish production of a new element.

"We have stated in the criteria that the 'mere first observation of a radioactivity without proof of its atomic number has not historically been considered sufficient to constitute discovery'," explains Hoffman.

Also in the criteria is a suggestion that composite nuclear systems that live less than about 10^{-14} seconds (the generally accepted upper limit for compound nucleus lifetime) should not be considered new elements.

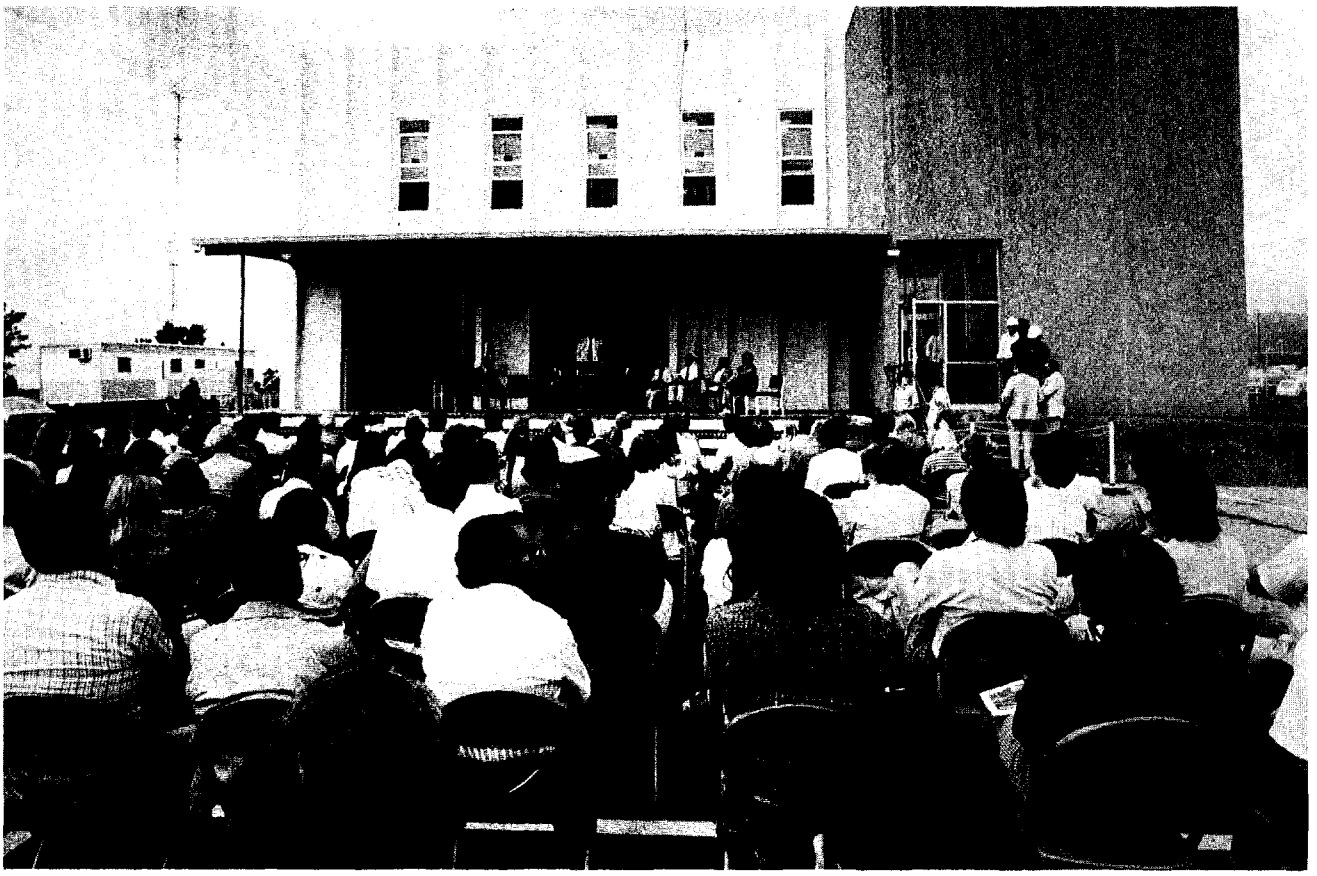
Hoffman and the panel on criteria stated that any claims to discovery of a new element should be published in a refereed journal with sufficient data to enable the reader to judge whether the evidence is consistent with such criteria.

The report on criteria concludes by suggesting that the name for a new element should not be proposed by the discoverers until the initial discovery is confirmed.

"Certainly there are conflicts ahead, and there still is the new element 105, with disputed claims to discovery to contend with," said Hoffman.

Berkeley and Dubna both claim discovery of element 105, for which Dubna proposes the name Nielsbohrium and Berkeley proposes the name Hahnium. Discovery of element 106 also has been claimed by both groups, but so far neither has proposed a name.

"Our committee's first concern, however, is trying to help find a solution to elements 104 and 105 problems. Perhaps after resolution of the present controversy, there will evolve a better procedure for evaluating claims to the discovery and naming of new elements," said Hoffman.



Los Alamos Scientific Laboratory employees and guests listened to addresses by several speakers before touring the new Treatment Development Facility.

Dedicated August 19

TDF Studies Waste Management

Every piece of paper, cardboard, wood, plastic, glass, rubber, ceramics, and metal taken into a plutonium processing area must be regarded as contaminated and must be handled and disposed of accordingly.

To find safer, cheaper ways to reduce the volume and eliminate the combustibility of such low-level contaminated waste is the goal of the new Treatment Development Facility (TDF) at the Los Alamos Scientific Laboratory.

Dedicated in ceremonies August 19, the TDF is the first Energy Research and Development Administration (ERDA) facility constructed solely for the study of waste management methods. It was built at a cost of $900,000 through ERDA's Division of Nuclear Fuel Cycle and Production, and is expected to be fully operable and handling radioactive wastes by mid-1977 with the first process selected for evaluation based on conventional incineration.

Harold Agnew, Director, welcomed guests and dignitaries, including New Mexico's U.S. Senator Joseph M. Montoya, and U.S. Representative Manuel Lujan, Jr., both members of the Joint Committee on Atomic Energy, and Alex F. Purge of ERDA's Division of Nuclear Fuel Cycle and Production.

George Voelz, head of LASL's Health Research Division, which has as part of its operation the LASL waste management program (H-7), said at the dedication, "The importance of the facility is not its size or cost. It's importance is that it addresses a current need.

"The handling of radioactive

waste really is not the problem. Technically we can handle the waste safely. The problem is lack of time. We must do the right things quickly so the nuclear industry can benefit from our research," he added.

Thomas K. Keenan, in charge of the LASL waste management program, describes the TDF as the focal point of the program. A variety of waste-handling research activities will be housed in the 10,600-square-foot building.

The process currently being installed uses a conventional incinerator, similar to ones used in municipal disposal programs, but it will be modified to confine radioactivity and protect workers from contamination.

Lee Borduin, who will supervise the daily operation of the TDF, says a task force of the Atomic Energy Commission (AEC), ERDA's predecessor, conducted an intensive study of radioactive waste disposal methods, and one finding of the task force was that incineration promised to be the very best way to accomplish goals of low-level waste handling.

LASL's Treatment Development Facility, purely a research and development effort, will handle up to 100 pounds of waste per hour in a program designed to provide an economic comparison of this method of volume reduction to other methods. Results of the "figure of merit" economic comparison, says Borduin, will be passed on to industry.

The incinerator already has burned noncontaminated materials such as plastic, rubber, paper, and rags in tests, and additional "cold" tests will be conducted before operation with radioactive material. Beginning in mid-1977, material generated in LASL plutonium operations will first be assayed for transuranic content (the amount of heavy elements, primarily plutonium, present in the trash), then shipped in sealed cartons to the TDF.

The cartons will enter a glovebox train where they will be reassayed for transuranic content, then scanned for metal objects by an x-ray machine like those used at airports for inspecting luggage. If metal is present, the waste will be sorted before being fed into the lower chamber of a dual-chamber incinerator.

Natural gas burners heat the lower chamber to produce a 1,500-degree-Fahrenheit "gentle" fire, which minimizes the amount of ash carried out with the exhaust. Combustion gases and some ashes rise to the upper chamber, heated to more than 2,000 degrees Fahren-

U.S. Representative Manuel Lujan, Jr. makes an amusing comment at the TDF dedication, prompting smiles from U.S. Senator Joseph M. Montoya and Director Harold Agnew.

Director Harold Agnew guides Senator Montoya, Representative Lujan and several other special guests on a tour of the Treatment Development Facility.

heit, to complete the combustion process.

Borduin explained that the waste will be reduced in volume to about 5 per cent of its original bulk. The cooled ash is vacuumed from the lower chamber and measured for plutonium content again before being sealed into containers for retrievable storage or burial.

High-temperature gases produced in the incinerator flow through the "off-gas" section of the facility and are quenched with water to 200 degrees Fahrenheit, then scrubbed repeatedly to remove particles.

Acids generated by the burning of certain materials will be removed by contact with water. Process cooling water will be circulated through an evaporative cooling tower to reduce the amount of liquid effluent discharged from the facility. Neutralizing compounds will be added to scrubbing solutions before they are discharged with the water to a nearby liquid treatment plant.

Air discharged from the facility to the atmosphere will be much cleaner than specified by Environmental Protection Agency regulations.

Keenan noted that the equipment will undergo numerous tests of capability and efficiency. "Maintenance and repair of the facility's various pieces of equipment while in operation are factors we will be studying carefully," he added.

Technicians will replace bearings in a shredder and make other repairs or adjustments during training exercises over the next several months while the facility is handling noncontaminated trash. "We'll get the experience and expertise in repairing and maintaining the equipment now, so when we're handling radioactive trash in mid-1977 we can solve problems that may arise," he explained.

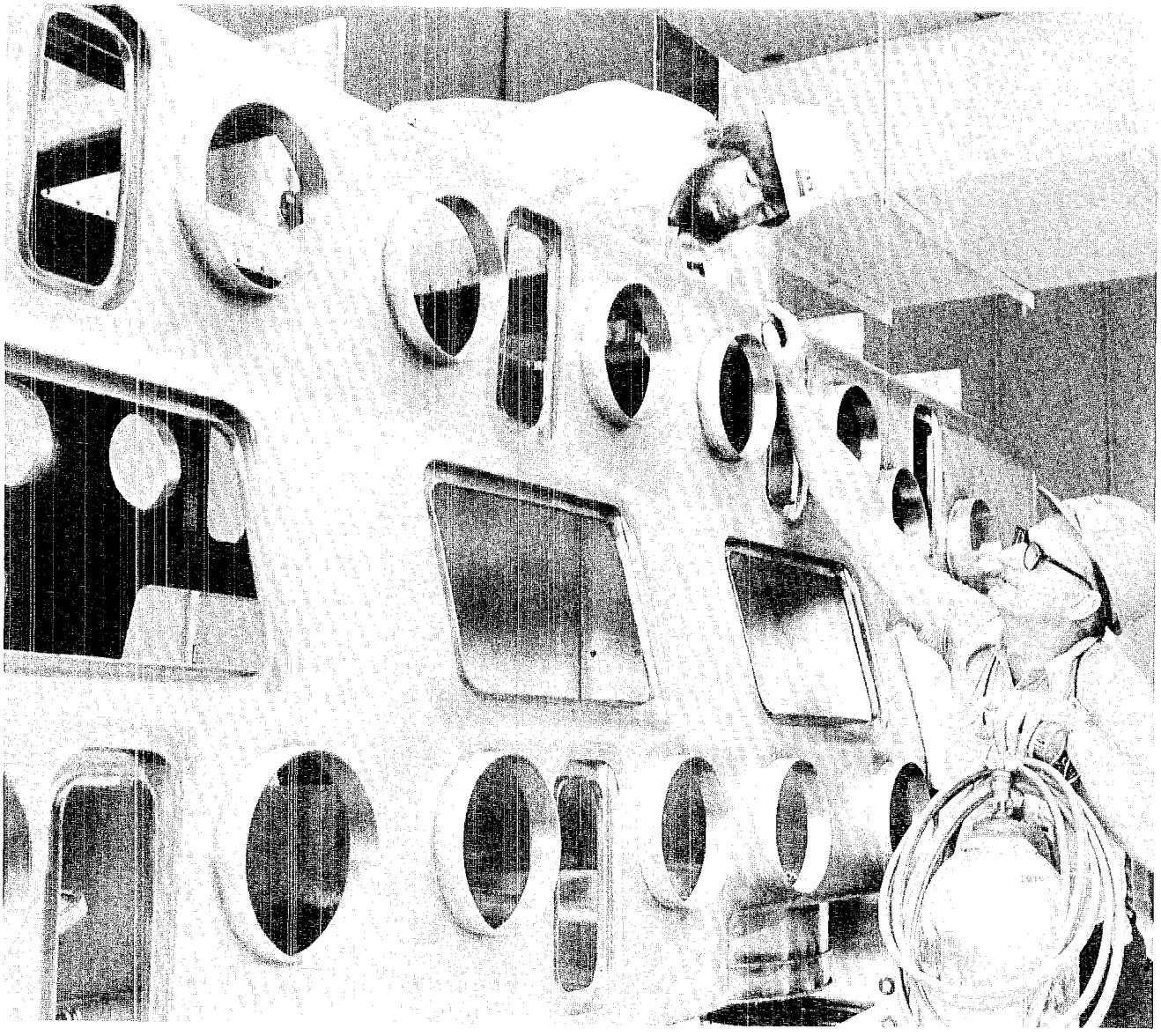
"The Problem Is Lack Of Time."

Principal researchers in the new facility program in addition to Keenan and Borduin are Wiley Draper, Ralph Koenig, Allen Neuls, Charles Warner, and Bill Whitty, all H-7.

Offices for the project personnel occupy 2,100 square feet of the building, with primary and support laboratories taking 5,300 square feet. The process evaluation laboratory, the work area for the testing of large, production-scale waste processing equipment, occupies 3,150 square feet of the first floor. The balance of floor space is used for a staff shop, decontamination room, and building utilities.

Keenan noted that LASL has funding for construction of a warehouse and storage area to serve the TDF, "and we expect the project to get under way some time this fall."

Upon completion of the Treat-



Ralph Koenig, left, and Wiley Draper complete installation of a glovebox that will be used to assay the plutonium content of low-level contaminated waste from plutonium processing areas. The waste materials will pass from the glovebox to a dual-chamber incinerator for burning to reduce volume.

ment Development Facility's initial study in waste management methods, design criteria and recommended operating procedures will be prepared for controlled-air incineration use throughout the nuclear industry.

Improved radioactive waste assaying, packaging, and storage are other areas the TDF staff will be studying in cooperation with personnel from CMB, R, and WX Divisions. These studies, together with the volume reduction program, reflect the ERDA commitment to upgrading all radioactive waste management practices.

Afternoon on the Rocks

There are many experienced mountain climbers in the Los Alamos area and at Los Alamos Scientific Laboratory, according to Don Liska, an engineer at MP-9.

"It seems that where there are technically-oriented people, there are people interested in technical climbing," he said.

Liska and a physicist with the University of Wyoming, Tom King, who is engaged in an experiment at LAMPF, recently demonstrated several basic climbing techniques during an afternoon of "bouldering."

According to the climbers, prussiking is ascending a boulder by rope, and descending a boulder by rope is rappelling. Two ways to move up or down the surface of boulders for short distances, usually without aid of a rope, are layback-ing (shown in the photo on page 18) and stemming, depicted in the cover photo.

"What we do on an afternoon out here on the boulders is not mountain climbing. Bouldering, or rock climbing, is only a very small part of the whole picture, and it serves really as exercise, practice, and diversion. Mountain climbing expeditions are another story," added Liska.

Liska and King are careful to point out that persons with no experience in rock climbing should not attempt the techniques illustrated in these photos. If a person wants to learn bouldering, he or she should affiliate with a climbing organization to learn how to do it

In the photo at left, Don Liska demonstrates the layback method of climbing the face of a boulder by inserting hands into a crack and pushing against another surface of the boulder with the feet. By pulling and pushing simultaneously, body friction helps the climber cling to the surface. At right Liska tosses a rope over the edge of a cliff, down which he rappels in the photo on Page 20.

under the supervision of professionals.

Bouldering is not difficult, and can provide enjoyment and experience leading to participation in mountain climbing, Liska suggests, but safety and proper instruction are prerequisites.

Liska has been climbing mountains for about 25 years, and has been on expeditions to South America, Asia, Canada and Alaska. King, a native of the mountainous northwest of the U.S., also has many years of climbing experience.

short subjects

Robert J. Van Gemert, SP-Department head, has been appointed national chairman of the National Association of Purchasing Management (NAPM) organization and planning committee, which studies the physical structure of NAPM and recommends plans and action for progress of the association.

David C. Cartwright, alternate group leader of T-6, will direct a research project that recently received a 24-month, $40,000 support grant from the National Science Foundation. Entitled "Study of Elastic and Inelastic Scattering of Electrons by Atoms," the project is a furtherance of the United States-Brazil Cooperative Science Program.

An idea for simplifying and making safer the job of loading drums into solvent storage cabinets was developed by **David S. Shaffer,** CMB-14, and it won him $15. His idea was also published in a recent issue of **National Safety News,** a publication of the National Safety Council. Shaffer's idea was the winning entry for July in the "Ideas That Worked" feature of the magazine.

Jose A. Trujillo, SP-4 truckdriver, this summer won a first-place trophy in the New Mexico State Truck Safety Contest in Albuquerque. Competing in the tractor semitrailer five-axle class, Trujillo was judged by a written examination, an oral interview, a vehicle safety inspection, and a driving test. The contest scoring system was based on safety in both driving and the handling of hazardous materials.

John Bartlit, Q-26, has been appointed to the environmental advisory committee of the U.S. Federal Energy Administration.

The Lab's Omega West Reactor (OWR) recently had its 20th birthday. The reactor first achieved criticality on August 2, 1956, and in its 20 years of operation the OWR has produced about 475,000,000 kilowatt-hours of energy.

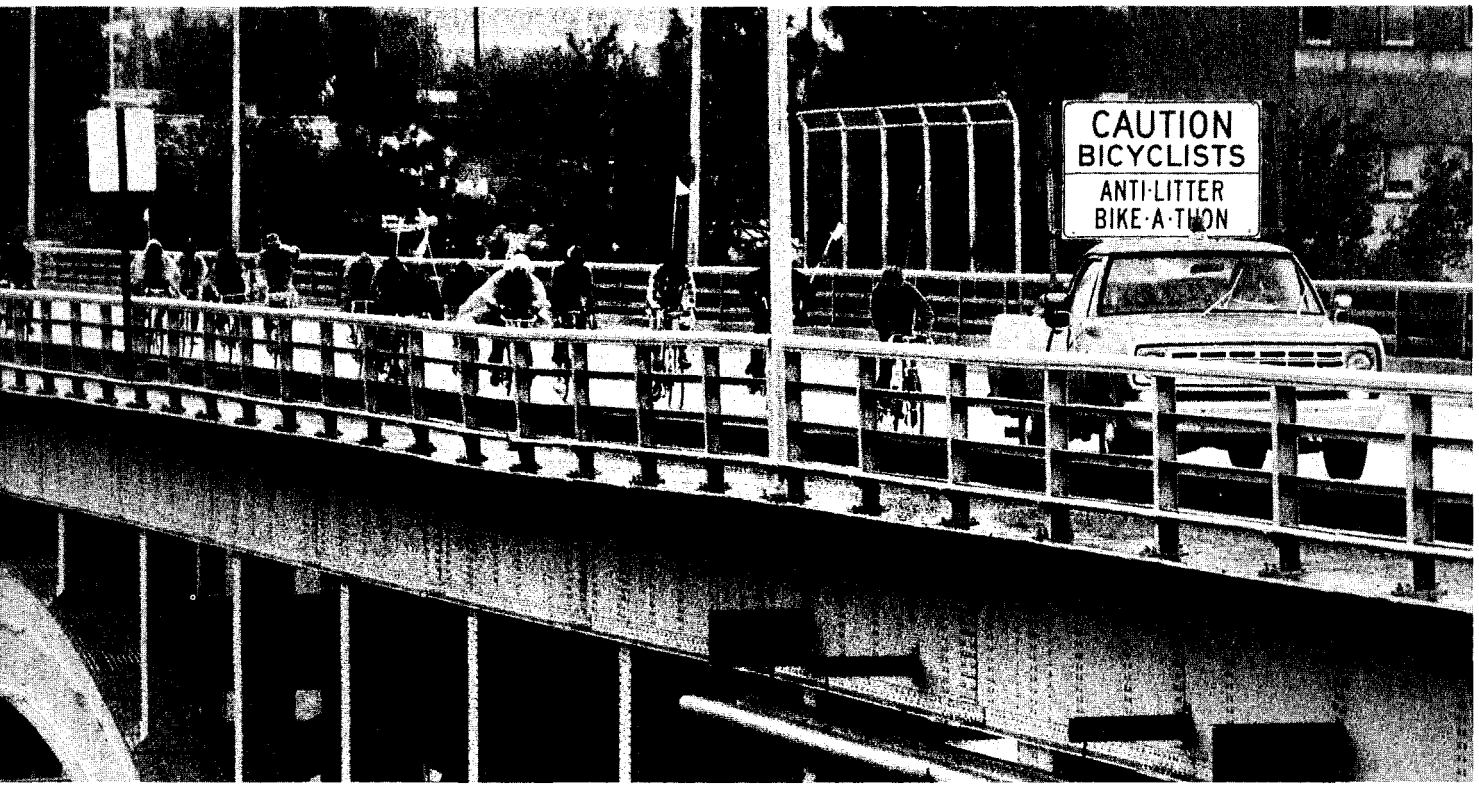
David A. Freiwald, assistant to the associate director for research, has been appointed to the Institute Advisory Council of the New Mexico Energy Institute at the University of New Mexico. The Institute has been assigned statewide responsibility for administering state-funded programs in the areas of energy conservation, nuclear fuel cycle, synthetic fuels, and socioeconomic impacts of energy programs.

Retirements: **William Moxley,** SD-5, branch shop foreman; **Wilma Moxley,** PER-5, training assistant; **William Briscoe,** E-DOR, staff member; **John Kinker,** WX-3, staff member; **Marion Rector,** SD-5, laboratory machinist; **Sylvia Wohlberg,** C-3, program library clerk, **Hazel Sims,** WX-1, property clerk; **Charles Canfield,** PER-DO, department head; **George Bucy,** WX-3, unit leader; **Robert Canada,** TD-DO, staff member; **John Farmer,** WX-3, staff member; **William Kelley,** SD-5, branch shop foreman; **George Peel,** WX-3, high explosives development machinist; **Hans Sembach,** CMB-7, design draftsman; **Willis Leatherwood,** SD-5, laboratory machinist; **Jeanne Hasty,** CNC-11, chemical technician; **Robert Tanner,** WX-4, staff member; **Theodore Trujillo,** H-10, staff member.

Robert P. Godwin, L-4 alternate group leader, has received a Fulbright travel grant for 1977. The grant will be used for travel to and from a guest researcher position at the Max Planck Institute for Plasma Physics in Garching, Germany, where Godwin will be working in the laser-produced plasma experiments group.

On Sunday morning, September 12, a proton beam was successfully transported the entire length of the Weapons Neutron Research facility beam channel at LAMPF. The accomplishment is considered an important step in development of the facility, which is expected to be operating by February 1977. Assembly of the target components and the bending magnet system which transports the beam out of the channel and onto the target is continuing.

Deaths: **Bobby Martinez,** ENG-3, reproduction technician; **Edward Sass,** SD-5, branch shop foreman, **Ralph Hanneman,** CTR-4, senior designer, **Joseph W. Chenault,** WX-7, electronics technician.



An August rain shower did not slow these bicycle riders (shown are some of more than 80) who passed through Los Alamos on their anti-litter bike-a-thon from Taos to Santa Fe. The riders stopped at several places in Los Alamos, including LASL's Bradbury Science Hall and Museum. The purpose of the bike-a-thon was to illustrate the bike riders' belief that such events can take place without littering or defacing the environment.

Charlie Steen, archaeological consultant to Los Alamos Scientific Laboratory, examines a volcanic ash rock he says was used by Pueblo Indians as a corn goddess or earth goddess in kiva religious ceremonies. The stone, supposedly resembling the figure of a female diety, is estimated to be 600 years old and was found this summer on the floor of a kiva during excavation of ruins near TA 54. Steen explained that the Indians may have placed pollen or prayer feathers on the stone, which is about 10 inches tall and 7 inches across the base. There have been only 8 or 10 reported findings of such stone goddesses in ruins in Northern New Mexico he said.

Photo Shorts

If an experiment calls for moving a small silicon detector by remote control across a secondary beam of high-energy electrons, how can it be done inexpensively and effectively? With ingenuity, and an electric train, of course. Several Los Alamos Scientific Laboratory researchers were involved in an experiment—conducted as a joint venture between LASL and the Fermi National Accelerator Lab (NAL) near Batavia, Ill.—in August to study the energy loss of ultra-relativistic electrons in thin silicon detectors. The LASL group, from left, William Ogle and Charles Gruhn, both of E-DOR, Ron Wagner, E-2, Suzanne Stotlar, E-DOR, Phil Goldstone, P-9 postdoctoral appointee, Leonard Stovall, M-3, and Carl Maggiore, E-DOR, were told by NAL that they would have to move the detector by remote control across the beam, produced after the proton beam struck a target and emitted the secondary beam of electrons. They opted for the train setup, at a cost of about $200, and it worked.

Clay T. Whitehead, who was executive secretary of President Ford's transition team, spoke on "The Nixon-Ford Transition" at a colloquium in August. In 1969-70 he was special assistant to President Nixon, and from 1970 to 1974 was director of the Office of Telecommunications Policy in the White House. From May to August, 1974, he organized the planning for the Ford presidency.

Roger B. Perkins

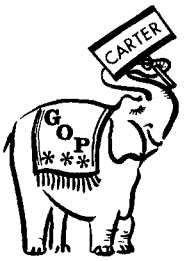
Roger Perkins Named Head of L-Division

Roger B. Perkins, a staff member at LASL since 1959, has been named head of L-Division. Perkins succeeds Keith Boyer who was named LASL assistant director for advanced technologies on July 1. In related appointments, Gene H. McCall was named alternate L-Division leader and Franklin P. Durham was made associate L-Division leader. Perkins, alternate P-Division before being selected to head L-Division, received his Ph.D. in physics from Princeton University in 1959.

Cowan Honored

George A. Cowan, CNC Division leader, has been selected to receive the New Mexico Academy of Science's Distinguished Scientist Award. Cowan was recognized for his investigations into the synthesis of elements by multiple neutron capture, nuclear reaction mechanisms and for his analysis of data related to natural fission reactors.

10 years ago in los alamos



CULLED FROM THE SEPTEMBER AND OCTOBER, 1966 FILES OF THE ATOM AND THE LOS ALAMOS MONITOR BY ROBERT Y. PORTON

LASL SELECTED AS LANDMARK

In the Historic Sites Act of 1935, Congress declared "it is a national policy to preserve for public use historic sites, buildings and objects of national significance for the inspiration and benefit of the people of the United States." Such an historic site, to be designated this month as a registered National Historic Landmark, is the Los Alamos Scientific Laboratory. According to the declaration of the U.S. Department of the Interior, a small log and stone structure on Trinity Drive has been erected to house the plaque. A duplicate of the plaque will be placed at the entrance to the LASL Science Museum.

SCIENTISTS CONVERGE HERE FOR SINS

Scientists from throughout the world came to Santa Fe and Los Alamos last week for SINS. Don't be hasty, it's not what you may think. It was all quite respectable. In this case SINS is defined as (S)eminar on (I)ntense (N)eutron (S)ources. The Seminar—the first of its kind—was held in Santa Fe under the joint sponsorship of the U.S. Atomic Energy Commission and the European Nuclear Energy Agency. LASL served as host, and one of the highlights of the week-long meeting was a tour of certain unclassified areas of the Laboratory. Attending the conference were an estimated 170 internationally known scientists from Poland, Japan, India, Canada, Australia, the United States and three international nuclear energy organizations (EURATOM, IAEA, and ENEA).

VP VISITS THE HILL!

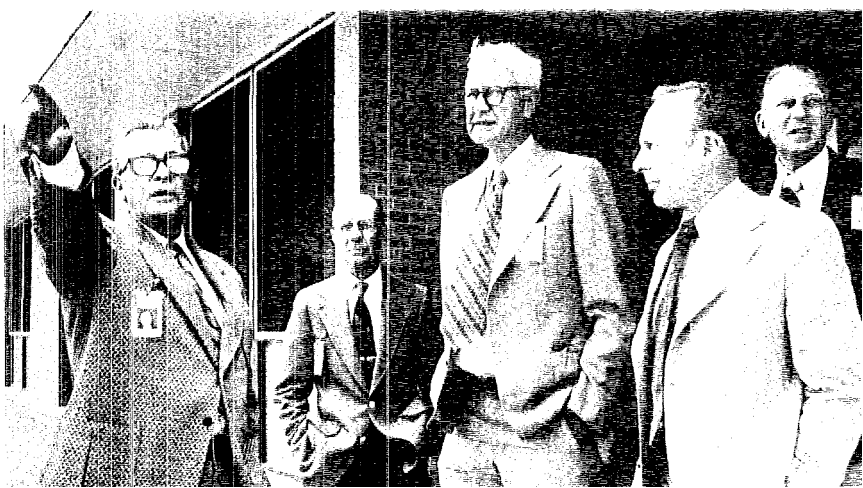
Vice President Hubert H. Humphrey lived up to his tag "Hurricane Hubert" Saturday when he toured portions of LASL. From touchdown to takeoff the Vice President was in Los Alamos for about 3 hours. But in that relatively short period of time, he: shook hundreds of hands at the airport, received a classified briefing on weapons research in the "Blue Room," toured the Physics Building and received information on the proposed Meson facility, was briefed on Project Rover at a Kiva at Pajarito Site, toured the Hall of Science where he manipulated a mechanical arm in the mock-up of a hot cell, attended a short reception, and took part in a news conference.

Among Our Guests

Charles W. Robinson, Deputy Secretary of State, examines a sphere of plutonium as Director Harold M. Agnew explains facts about plutonium during Robinson's recent tour of the Laboratory.

Anne Sayer, right, author of the book Rosalind Franklin and DNA, discusses some points from her August colloquium talk, "What Scientists Owe Each Other," with Sigrid McAfee of Los Alamos.

H. Glubrecht, deputy director general, department of research and isotopes, International Atomic Energy Agency, Vienna, Austria, spoke on "Activable Tracers in Environmental Research" at an August colloquium.



Three Energy Research and Development Administration (ERDA) officials recently toured LASL's plutonium handling facility currently under construction. From left, William Maraman, CMB-11 group leader, and Richard D. Baker, CMB Division head, explain facility operations to Alfred E. Starbird, ERDA assistant administrator for national security; Maj. Gen. Joseph K. Bratton, USA, ERDA director of the division of military application; and Herman Roser, manager of ERDA's Albuquerque Operations Office.